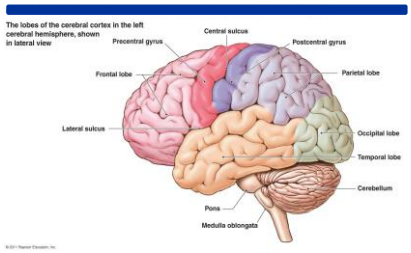
The Neuropsychology of Learning Disabilities:
Developing Evidenced-Based Reading, Writing, and Math Interventions



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Course Outline: Module #4

- Six part webinar series on reading, writing, & math disabilities sponsored by Jack Hirose & Associates.
- Introduce a brain-based educational model of dyslexia, dysgraphia, and dyscalculia and classify each disability into distinct subtypes.
- Discuss targeted interventions for all students with academic learning issues.
- Questions and Comments?

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  - 2008 MD School Psych of Year
  - 2009 NASP School Psych of Year
  - Authored 7 books
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Presentation Goals

1. Discuss national trends in written language, and the need for educators and psychologists to explore writing from a brain-based educational perspective.

2. Discuss the neural architecture of language development in children and learn key frontal lobe brain processes responsible for the organization and production of written language.

3. Introduce a *brain-based* educational model of diagnosing written language disorders by classifying into three distinct subtypes, with specific remediation strategies linked to each subtype.

4. Introduce a comprehensive dysgraphia evaluation to assess *seven* core cognitive constructs associated with written language disorders in children.

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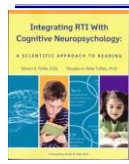
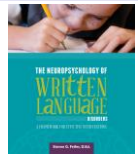
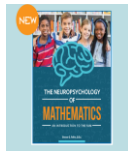
Further Reading Materials







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Case Review

Cole: 3rd grade…Attention issues…no interventions

WISC V Composites	COMPOSITE SCORE	CONFIDENCE INTERVAL	RANGE	PERCENTILE RANK
Verbal Comprehension Index	85	78- 92	Low Average	16%
Perceptual Reasoning Index	100	92 – 108	Average	50%
Fluid Reasoning Index	90	83 - 97	Average	25%
Working Memory Index	77	71 – 86	Very Low	6%
Processing Speed Index	78	72 – 90	Very Low	7%
Full Scale Score	83	79 – 88	Low Average	13%

WIAT-III WRITING SUBTESTS	SCORE	PERCENTILE	RANGE
Spelling – the student writes words dictated by the examiner from a word list.	86	18%	Below Average
Sentence Composition – this subtest has two separate parts. First, the student combines two or more sentences into a single sentence that maintains meaning, and also uses correct punctuation and grammar skills *(Sentence Combining)*. In the second part, the student constructs a sentence from a stimulus word provided *(Sentence Building)*.	95	37%	Average
Essay Composition – the student has ten minutes to construct an essay about a favorite game or activity, and must list specific reasons for liking the game or activity.	80	9%	Below Average
WRITTEN EXPRESSION SCORE	85	16%	Below Average

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How Do You View a Learning Disability?

Discrepancy Psychologist – There is no discrepancy between his overall ability and achievement. Therefore, Cole has no learning issues, and no interventions are warranted.

RtI Psychologist – There is no indication that Cole has been exposed to a tiered level of evidence based interventions. Therefore, let's wait and see how he responds (trial and error approach).

PSW Psychologist – More testing is needed to determine if there is a pattern of cognitive strengths and weaknesses that justify an LD label. However, confusion remains as to which processes should be tested??

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School Neuropsychological Assessment

Neuropsychology: **An analysis of learning and behavior that examines *brain-behavior* relationships.**

- **Assessment for a disability is based upon a brain-behavioral paradigm which attempts to describe how a child learns and processes information by surveying underlying cognitive processes.**
- **Dysgraphia processes can be cognitive-linguistic or motor output based. 3 Subtypes.**

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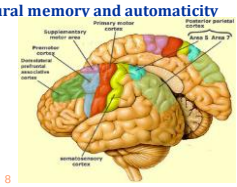
3 Subtypes of Written Language Disorders

(1) Graphomotor Dygraphias - apraxia refers to a wide variety of motor skill deficits in which the voluntary execution of a skilled motor movement is impaired.

a) **Premotor cortex plans the execution of a motor response.**
b) **Supplementary motor area – guides motor movement**
c) **Cerebellum - provides proprioceptive feedback.**
d) **Basal Ganglia – procedural memory and automaticity of handwriting.**



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Motor Skills Deficits in Writing

DISORDER	DESCRIPTION	BRAIN REGIONS
Developmental Coordination Disorder	Inability to properly develop the coordinated movements necessary to executive a particular motor response.	Premotor Cortex Supplementary Motor Cortex Motor Strip Basal Ganglia Cerebellum
Developmental Dyspraxia	Refers to a wide range of skills involved more in the planning and execution of a voluntary motor movement.	Premotor Cortex Supplementary Motor Cortex Motor Strip
Ataxia	A coordination disorder involving trouble regulating the force, range, direction, velocity and rhythm of muscle contractions due to specific dysfunction of the cerebellum.	Cerebellum
Ideomotor Dyspraxia	A failure to voluntarily carry out a motor act or gesture on command, though the self-same motor act can be effectively executed if done so in a spontaneous manner.	Exner's Area Supplementary Motor Area
Ideational Dyspraxia	Isolated motor skills are in tact, but difficulty arises when stitching together large chains or sequences of movements involving complex motor planning.	Left Superior Parietal Lobe
Constructional Dyspraxia	A breakdown in the visual-spatial synthesis of written production or what is often referred to as visual-motor integration.	Right Posterior Parietal Lobe

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8 Key Behavioral Observations

1. Does the student have enough space on their desk?
2. Are both feet on the floor?
3. Does the student complain their hand is tired?
4. Does the student use excessive force?
5. Does the student use an immature grip?
6. Does the student constantly rub their eyes when writing or put their head down on the desk?
7. Does the student appear distracted?
8. Does the student use their opposite hand to anchor the page?

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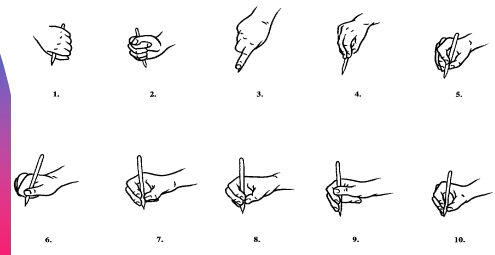
Types of Pencil Grips



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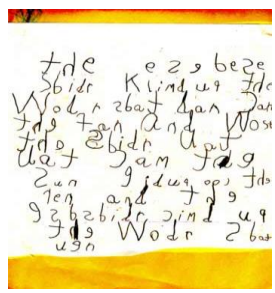
Example of Graphomotor Dysfunction



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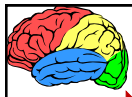
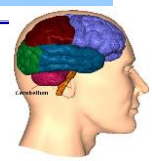
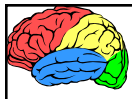


The Role of the Cerebellum



- The cerebellum contains 50% of neurons in the brain.
- Guides and corrects motor movements based upon proprioceptive feedback.
- Made up of purkinje cells and granule cells which are primarily excitatory, and help fine tune the writing process.
- Over time, the physical act of sequencing subtle motor movements from stored cognitive templates becomes less effortful and more reflexive.
- Deficits mainly lead to motor coordination issues….ataxia….("3971" ATM Code: spatial/sequential)



(2) Dyslexic Dysgraphias: Spelling Miscues

a) Dysphonetic dysgraphia - the hallmark feature of this disorder is an inability to spell by *sound* due to poor *phonological* skills. There is often an over-reliance on the visual features of words when spelling.

Target Word	Misspelling
point	*pot*
train	*chan*
old	*od*
climbing	*cling*
job	*joib*
video	*veio*
kitchen	*tihn*

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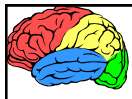

(2) Dyslexic Dysgraphias: Spelling Miscues

b) Surface dysgraphia - a breakdown in the *orthographic* representation of words. Miscues made primarily on phonologically irregular words.

Target Word	Misspelling
knock	*nok*
build	*bild*
mighty	*mite*
juice	*juse*
onion	*unnyun*
said	*sed*
yacht	*yot*
laugh	*laf*

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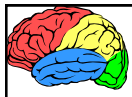

(2) Dyslexic Dysgraphias: Spelling Miscues

c) Mixed Dysgraphia - characterized by a combination of both *phonological* errors and *orthographical* errors depicting faulty arrangement of letters and words.

Target Word	Misspelling
advantage	*advangate*
cobweb	*coweb*
illusion	*elushn*
pocket	*poet*
work	*wrok*
kitchen	*kinchen*

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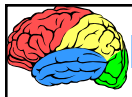

3 Subtypes of Written Language Disorders

(3) Executive Dysgraphias - an inability to master the implicit rules for grammar which dictate how words and phrases can be combined. Deficits in *working memory* and *executive* functioning in frontal lobes hinders syntax!

- Word omissions
- Word ordering
- Incorrect verb usage
- Word ending errors
- Poor punctuation
- Lack of capitalization
- Oral vs. written language discrepancy

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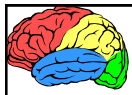

3. Executive Dysgraphia

a) Verbal Retrieval Skills – the frontal lobes are critical in retrieving words stored throughout the cortex, often stored by semantic categories.

b) Working Memory Skills – helps to recall spelling rules and boundaries, grammar rules, punctuation, and maintaining information in mind long enough for motoric output.

c) Executive Functioning Skills – syntactical arrangement of thought needed to sequence mental representations.

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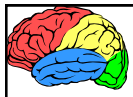

Verbal Retrieval Strategies
(Uhry & Clark, 2005)

(1) Integration – vocabulary instruction should be woven into the content area being studied and not taught in isolation from specific context.

(2) Semantic Mapping – teaching new vocabulary words through classroom discussions allow students to associate new terminology with already learned words in conjunction with their own background and experiences.

(3) Concept Formation – teachers should always teach broad generic concepts first, then specific vocabulary words second. For example, introduce the concept of *"liberty"*, then ask if specific words such as *"emancipation"* or *"independence"* fit their conceptual schema of *"liberty"*.

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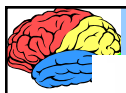
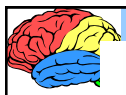


Teach Transition Words

Transition Words

- first, second, third
- first, also, besides
- one, another, last
- one example, another example, a final example
- initially, then, after that
- a good, a better, the best
- to begin, then, consequently
- as soon as, next, later
- to start, furthermore, in conclusion
- first, another, next
- initially, another, then, finally

- Although
- However
- Instead of
- Additionally
- In contrast
- Similarly
- While
- A couple
- Before
- After
- Because
- Since
- Even though
- Until
- Moreover
- In order
- Unless
- Likewise
- meanwhile
- A number of
- As if
- As soon as
- In conclusion
- Finally
- Most importantly
- In fact



Teach Conclusions

Writing Conclusions

- ☐ Restate, reword or summarize your topic sentence or your thesis statement.
- ☐ Use different words (synonyms) than the words you used in topic sentence and/or thesis.
  - different action verbs
  - different adjectives
- ☐ Begin concluding sentences with one of these words or phrases in them:
  - In conclusion
  - To sum up
  - Obviously
  - In closing
  - captures
  - illustrates
  - suggests
  - confirms
  - summarize
  - describes
  - recommend
  - supports
  - clearly
  - surely
  - expresses
- ☐ Remind the reader of the main points in your writing.
- ☐ Convince the reader one more time of your position or opinion.
- ☐ Make general statements that widen the reader's perspective.
- ☐ Challenge the reader, give them something to think about, and encourage the reader to take action.
- ☐ Make a statement about how the writing may affect their life, give some advice or help them in some way.

Working Memory (Baddeley, 1998)

- ***Phonological Loop*** - holds and manipulates acoustic information. Housed in *left temporal lobes* and plays a role in word retrieval skills and hearing the temporal order of sounds when spelling.
- ***Visual-Spatial Sketchpad*** - holds visual, spatial, and kinesthetic information in temporary storage by way of mental imagery. Housed along inferior portions of *right parietal lobes* and plays a role in visualizing word forms when spelling.
- ***Central Executive System*** – allocates attention resources whereby two cognitive tasks can be executed. *Anterior cingulate* in *frontal lobes.*
- Impacted by anxiety, inattention, and emotional distress!!!

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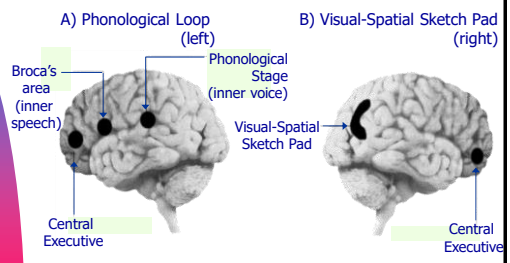
Working Memory Systems



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Academic Pitfalls of Working Memory Dysfunctions

- Listening - confusion following multiple step directions.
- Speaking - word finding issues, tip-of-the tongue phenomena, losing train of thought.
- Behavior - tendency for more immediate needs to undermine long-term goals.

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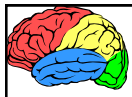
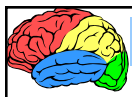


Academic Pitfalls of Working Memory Dysfunctions

- **Math** - tendency to forget sequence of steps when solving longer math equations.
- **Reading** - poor comprehension
- **Writing** - difficulty simultaneously recalling rules for spelling, punctuation, spacing, organization, and clarity.

Anxiety and self doubt reduces *"cognitive counterspace"* when problem solving.



What Are Executive Functions?

- Directive capacities of the mind.
- Part of neural circuits that are routed through the frontal lobes.
- Multiple in nature, not a single capacity
  (i.e. planning, organizing, time management, strategy, etc…)
- Coordinates linguistic output through proper sequential arrangement of language (syntax) often by verb usage.
- The concept of *executive functions is* **not** synonymous with the concept of IQ!!

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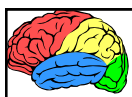
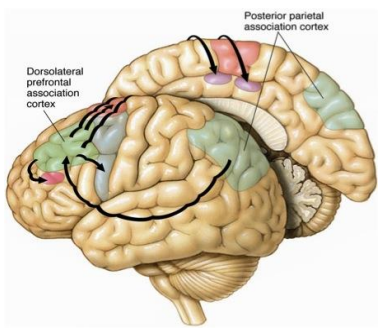


Executive Functioning and Writing



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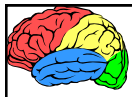

Executive Functioning and Written Language

Classification	Writing Dysfunction
(1) Initiating	* Poor idea generation * Poor independence
(2) Sustaining	* Lose track of thoughts * Difficulty finishing * Sentences disjointed
(3) Inhibiting	* Impulsive/Distractible
(4) Shifting	* Perseverations * "Stuck" on topic

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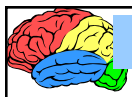

Executive Functioning and Written Language

Classification	Writing Dysfunction
(5) Poor Organization	* Frequent erasers * Forget main idea * Disjointed content
(6) Poor Planning	* Poor flow of ideas * Incorrect spacing * Lack of cohesive ties
(7) Poor Self Monitor	* Spelling miscues * Sloppy work * Careless errors

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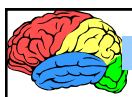

INTERVENTION KEYS: AUTOMATICITY

(1) Motor Skills Automaticity:
- Handwriting without tears
- Technology Devices

(2) Spelling Automaticity:
- Developmental approach integrating phonology,orthography,and morphology.

*(3) Executive Functioning Automaticity:
- Graphic Organizers
- Story Maps

*(4) Self Monitoring Automaticity:
- COPS Strategy
- Peer Review

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5 Spelling Strategies

1. **Learn the six syllable subtypes for vowel representations.**
   - More than 90% of English words follow the six-syllable type sound-spelling pattern. The six syllable rules are:
     - a) Closed syllables (just one vowel…"cat")
     - b) Open syllables (ends in long vowel…"baby")
     - c) Vowel-Consonant E Syllables (silent e elongates vowel…"make"
     - d) Vowel-Team Syllables (two vowels make one sound…"caution"
     - e) R-Controlled Syllables (vowel followed by "r"changes sound…"hurt"
     - f) Consonant-le Syllables (end of word ending in "le"…..."turtle")
   - Use grapheme tiles to practice spelling!

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5 Spelling Strategies

2. Incorporate nonsense words into weekly spelling instruction to show mastery of the spelling patterns.
3. Place a heavy focus on prefixes and suffixes during instruction.
4. Have students write each word with white space in between each syllable in the word using the box approach. *(i.e. fascinate)*

f a s c i n a t e

5. Have students color-code vowel digraphs in words *(i.e. Sauce)*

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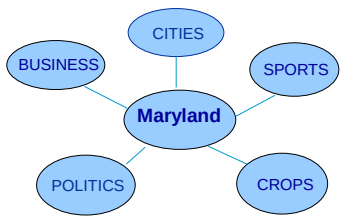
GRAPHIC ORGANIZERS

Graphic Organizers – this involves a pre-writing activity whereby the student simply lists a word or phrase pertaining to the topic. An example may include a brainstorming a web:



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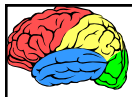

Self Monitoring Strategies

COPS strategy – a directional proof-reading strategy where the student re-reads their passage four times prior to completion.

1) Capitalize the first word of each sentence.

2) Organize the information by reviewing topic sentences and double check paragraph breaks. separations.

3) *Punctuation* miscues must be reviewed.

4) Spelling miscues must be reviewed.

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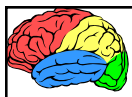

Self Monitoring: Writing Self Rubric

IDEAS

4 The topic and details are well developed.
3 The topic is clear but more details are needed.
2 Details that don't fit the topic confuse the reader.
1 The topic is not clear.

ORGANIZATION

4 The beginning, middle, and ending work well.
3 Some parts of the essay are unclear.
2 All parts of the essay run together.
1 The order of information is confusing.

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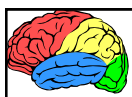


Self Monitoring: Writing Self Rubric

WORD CHOICE

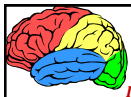
4 Words make the meaning clear.
3 Clearer words are needed.
2 Some words are overused.
1 Words are used incorrectly.

CONVENTIONS

4 Conventions are used well.
3 There are few errors.
2 Errors make the essay hard to understand.
1 Help is needed to make corrections

AUDIENCE AWARENESS

4 The passage is clear and understandable for the intended audience.
3 The reader may need background knowledge to fully comprehend.
2 There are some parts of the passage that are difficult to understand.
1 The passage is extremely confusing for the intended audience.



Strategies for Secondary Students

Inspirations **– teaches how to craft concept maps, idea maps, and other visual webbing techniques to assist in planning, organizing, and outlining. Very effective word predictive software.**

Kurzweil Technology **- adaptive technology to further practice grammar, spelling, and punctuation. Voice activated software also an option.**

Journal or Diary **– can be a fun and effortless way to practice writing on a daily basis.**

Keyboarding - speed up output to reduce pressure from working memory skills to retain information over longer periods of time.

Livescribe **- a *"smart"* pen which would both record lecture information in the class, as well as transcribe notes to a computer screen. Smart pens allow students to better organize their notes.**

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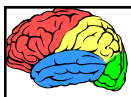

EmPOWER: Bonnie Singer

EmPOWER – teaches expository writing at all grade levels. It is a written language guide, not a curriculum, that can be used in all subjects.
Evaluate – pick apart my assignment to figure what I need to do.
Make a Plan – plan how I will do the assignment and choose my strategies.
Organize – organize my ideas using Brain Frames.
Work – work my ideas into writing.
Evaluate – assess the quality of my test.
Re-Work – make necessary changes.

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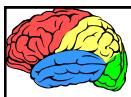

BRAIN FRAMES: (EmPOWER, Bonnie Singer)

Brain Frames – graphic organizers that allow students to organize their thoughts in order to:

Compare– tell how two things are alike.
Contrast – tell how two things are different.
Give Information– tell what you know about something.
Describe– use adjectives to describe a vivid scene.
Retell – tell a brief story about something that happened.
Opinion – express your beliefs about a topic.
Persuade – convince the reader to adopt your belief about a topic.
Summarize - restate the main ideas.

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Research Based Interventions
(Graham & Perin, 2007)

(1) Writing Strategies *(effect size .82)*
(2) Summarization (*effect size .82)*
(3) Collaborative Writing *(effect size .75)*
(4) Specific Product Goals *(effect size .70)*
(5) Word Processing *(effect size .55)*
(6) Sentence Combining *(effect size .50)*
(7) Prewriting *(effect size .32)*
(8) Inquiry activities *(effect size .32)*
(9) Process Writing Approach *(effect size .32)*
(10) Study of Models *(effect size .25)*
(11) Writing for Content Learning *(effect size .23)*

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5 Major Steps of Writing Process
(Ray, 2001)

(1) Prewriting - use graphic organizers.
(2) Drafting – use model to take notes and model how to organize in a text form using topic sentences.
(3) Revising – second draft emphasizing content, and elaboration of ideas and making connections.
(4) Editing – re-read for capitalization and punctuation errors.
(5) Publishing – peer assisted strategies and teaching students to give and receive feedback.

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Comprehensive Dysgraphia Evaluation

- Intelligence Measures (Gc)
- Visual-Motor Integration
- *Attention* (Gs)
- *Working Memory* (Gsm)
- *Executive Functions* (Gf)
- Writing and Spelling Skills
- Phonological Awareness Skills (Ga)
- Retrieval Fluency Skills (Glr)
- Social Emotional Measures

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Dysgraphia Assessment Instruments

- Visual-Motor Integration - WIAT III Alphabet Writing Fluency (30 sec), NEPSY II Design Copying, PAL II Alphabet Writing, PAL II Handwriting Subtests, WRAVMA, Dean-Woodcock, VMI
- Attention - NEPSY II Auditory Attn & Response Set, NEPSY II Inhibition, Connors 3, Tea-CH II, CAS-2 Receptive Attention, WJIV- Auditory Attention.
- Working Memory – WISC V, PAL II Verbal Working Memory Subtests, SB5, CAS2, WRAML-2, KABC II Word Order.
- Executive Functions - WIAT III Sentence Composition, PAL II Expository Note Taking, PAL II Narrative Compositional Fluency, BRIEF, DKEFS, NEPSY II, KABCII Rover, CAS2 Planning
- Writing and Spelling Skills – WIAT III Spelling (error analysis) PAL II Orthographic Spelling, WIAT III Essay Composition, PAL II Expository Note Taking &Writing, KTEA III, WJIV, OWLS
- Retrieval Fluency Skills - NEPSY II Word Generation, NEPSY II Speeded Naming, WJIV Retrieval Fluency, FAR.

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Dysgraphia Assessment Summary

1. Graphomotor Dysgraphia:
   - Visual-motor integration deficits
   - Slower motor speed
   - Sloppy penmanship
2. Dyslexic Dysgraphia:
   - Major spelling deficits
   - Poor phonological processing
   - Lower working memory skills
   - Poor variety of words displayed
3. Executive Dysgraphia:
   - Poor executive functioning skills
   - Limited attention
   - Slower retrieval fluency skills
   - Lower working memory skills
   - Limited output….careless miscues..grammar errors….simplistic sentence structures.

Feifer Assessment of Writing (Faw)

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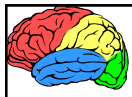

Let's Stay Connected!

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